COMMONWEALTH OF PENNSYLVANIA.

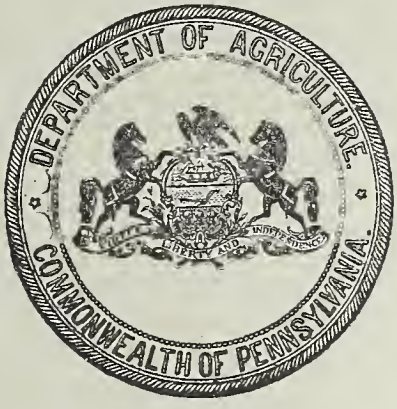
DEPARTMENT OF AGRICULTURE.

BULLETIN NO. 67.

METHODS OF STEER-FEEDING.

A Co-operative Experiment by the Pennsylvania State Department of Agriculture and the Pennsylvania State College Agricultural Experiment Station, Under the Immediate Supervision of

G. C. WATSON and M. S. McDOWELL.



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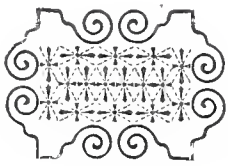

PREFACE.

Harrisburg, Pa., August 1, 1900.

The following Bulletin upon "Methods of Steer-Feeding" will be of interest to cattle feeders in Pennsylvania, as showing, from carefully kept data, the comparative effects of feeding by the old method of tying up and turning loose to water each day; the keeping tied in the stall with water constantly before the animals; and the system in which the cattle are loose with free access to water.

The experiment was undertaken by the Pennsylvania State Experiment Station at the instance of the Secretary of Agriculture of Pennsylvania, to test by accurate observation, some impressions suggested by his experience in feeding cattle, in which the animals were dehorned and turned loose in pens with abundance of water constantly supplied. The results show that this method has considerable advantage over the old practice, and that the animals thus kept gained more in weight, with less grain than the others, and that there was also a saving of over 31 per cent. in the expense of attendance.

The experiment was conducted under the immediate supervision and direction of Prof. Geo. C. Watson, Agriculturist of the Station, assisted by Mr. M. S. McDowell, Assistant Chemist, and is to be continued until the value of the several methods is fully demonstrated.

JOHN HAMILTON,
Secretary of Agriculture.

METHODS OF STEER-FEEDING.

A Co-operative Experiment by the Pennsylvania State Department of Agriculture and The Pennsylvania State College Agricultural Experiment Station under the Immediate Supervision of

G. C. Watson and M. S. McDowell.

At the suggestion of the Secretary of Agriculture, the following experiment upon methods of handling fattening steers has been carried out by the Department of Agriculture and the Experiment Station in co-operation. It is recognized that one season's experiment with fifteen animals is far from sufficient to settle the questions involved, and this Bulletin is to be regarded as a preliminary report only. It is hoped to continue the trials through succeeding years.

The close margin on which fattening steers are being fed by the farmers of Pennsylvania, compels them to look carefully for little wastes that heretofore have gone unchecked, and to secure the most efficient means of caring for their fattening animals at the least possible expense. On account of this close competition, the efficiency of methods employed for converting the coarse fodders of the farm and the commercial stock foods into beef are to be considered more closely than ever before, in order that the most economical way may be selected and the necessary expenditures of money and labor reduced to a minimum.

Plan of Experiment.

In order to ascertain the efficiency and practicability of certain methods, a practical steer-feeding experiment was devised for the purpose of determining, if possible:

1. The effect of different methods of supplying drinking water.
2. The efficiency of different methods of confining fattening animals.

In order to make a satisfactory test under practical conditions, a space to accommodate three lots of steers of five each was set apart in the basement of the college barn for this trial. The basement of this barn is 65x100 feet, with the ceiling 11 feet high, and is

largely used each year for steer-feeding. Lot I occupied a pen or large box stall 20 feet long and 11.5 feet wide, which is exactly the same space that five stalls had previously occupied, including the alley at the rear of the stalls used for access, cleaning them out, etc. Lot II occupied five stalls adjoining this pen. Lot III occupied five other stalls similar to those occupied by Lot II. Lot I, or those in the box stall, were fed from a common manger and supplied with drinking water kept before them all the time in an automatic watering basin, except when the water was withheld for a short time previous to weighing periods. Lot II was also supplied with automatic watering basins similar to Lot I. Lot III was watered by turning them out for an hour or two once each day in a large yard adjoining the basement, where they were permitted to drink in common from a large watering trough. The steers in Lots I and II were not removed from the pens or stalls except as it was desired to weigh them on alternate weeks.

Animals.

The steers used in this experiment were purchased at the stockyards at Pittsburg, November 20, 1899. They were dehorned grade Shorthorn steers, raised in Northeastern Ohio, and were carefully selected as to size, age and quality, so far as appearances would indicate. While individual characteristics, which proved some animals to be somewhat more desirable feeders than others, developed as the feeding progressed, yet all would have been called good feeding steers, either at the beginning or at the close of the experiment. These steers were sorted into lots soon after purchasing and were confined in the pen and stalls until December 14, when the experiment proper was begun. It was thought best to defer beginning the experiment for a few weeks in order that the animals might become accustomed to their new surroundings, and also to give an opportunity to discard any animal that might prove objectionable.

Rations Fed.

Each lot was fed grain, consisting of six parts of corn and cob meal and one part of wheat bran by measure, in such quantities as presumably would be readily consumed. An accurate account was kept of the amount of grain consumed by each lot, but the amount fed from day to day was left to the judgment of an experienced feeder. The grain for each lot was weighed out weekly and placed in a bin. At the end of the week that remaining in the bin was weighed and deducted from the amount previously weighed out. A similar account was also kept of the hay and corn stover consumed by each lot. The individuals of each lot were weighed on alternate weeks.

The Following Table Shows the Gain of Each Steer throughout the Experiment in Periods of Two Weeks Each:

Food Consumed.

Date.	Lot I.			Lot II.			Lot III.		
	Hay.	Fodder.	Grain.	Hay.	Fodder.	Grain.	Hay.	Fodder.	Grain.
For week ending December 21, 1899,	298.0	89.0	439.0	283.0	107.5	430.0	275.0	87.0	430.0
For week ending December 28, 1899,	255.5	96.5	459.0	235.0	103.0	456.0	245.5	67.0	456.0
For week ending January 4, 1900,	262.5	100.0	496.0	256.5	109.5	490.5	240.5	66.0	490.5
For week ending January 11, 1900,	260.0	117.0	491.0	259.0	124.5	490.0	237.5	52.5	490.0
For week ending January 18, 1900,	262.5	136.0	505.0	262.5	117.5	497.0	262.5	78.5	497.0
For week ending January 25, 1900,	262.5	121.0	535.5	262.5	106.0	533.0	262.5	60.0	533.0
For week ending February 1, 1900,	262.5	136.5	557.5	262.5	112.0	557.5	262.5	74.5	557.5
For week ending February 8, 1900,	262.5	124.5	595.5	262.5	81.0	593.5	262.5	70.0	593.5
For week ending February 15, 1900,	297.5	118.0	617.0	287.5	87.0	617.0	293.5	51.0	617.0
For week ending February 22, 1900,	288.5	111.0	608.0	291.0	102.0	601.5	293.5	65.5	601.5
For week ending March 1, 1900,	297.5	104.0	590.0	297.5	108.0	585.0	293.5	61.0	585.0
For week ending March 8, 1900,	297.5	112.0	619.5	297.5	98.5	619.5	295.0	63.0	619.5
For week ending March 15, 1900,	297.5	111.5	633.0	294.5	99.5	632.0	290.5	62.0	632.0
For week ending March 22, 1900,	297.5	91.0	639.0	285.5	83.0	623.0	296.0	46.5	623.0
For week ending March 29, 1900,	322.5	.....	617.5	326.0	.....	618.5	303.5	.....	618.5
For week ending April 5, 1900,	327.25	.....	515.0	327.25	.....	497.0	321.25	.....	497.0
For week ending April 12, 1900,	327.25	.....	539.5	323.25	.....	522.0	316.25	.....	522.5
For week ending April 19, 1900,	327.25	.....	596.5	324.25	.....	575.5	300.75	.....	575.5
For week ending April 26, 1900,	327.25	.....	610.0	319.25	.....	605.0	287.25	.....	605.0
Total,	5,533.50	1,568.00	10,663.5	5,457.0	1,439.0	10,543.5	5,339.5	904.5	10,544.0

The hay consumed by the three lots was of good and uniform quality, largely timothy with a little clover. The corn stover was well cured and shredded. The grain, as explained before, consisted of corn and cob meal and wheat bran, six parts of the former to one part of the latter by measure, or 10 pounds of meal to .9 of a pound of bran. The hay and corn stover were placed in large sacks and weighed on scales and taken from the sacks and placed in the mangers as required. That remaining in the mangers was weighed back and deducted from the total amount offered them, the difference giving the amount consumed. As the refuse in many cases was inconsiderable, it was not weighed back until a quantity had accumulated in the mangers. During the whole experiment, it was observed that Lot I was eating the hay somewhat closer than the other two lots, although this difference seemed to be so slight that it was not thought best to change the quantity offered them. The total amount of refuse, however, for the lot is shown by the following tabular statement:

Amounts of Hay and Stover Offered Each Lot and the Amounts Refused.

	Hay offered.	Hay refused.	Stover offered.	Stover refused.
Lot I,	5,533.0	54.5	2,512.5	944.5
Lot II,	5,457.0	131.0	2,512.5	1,073.5
Lot III,	5,339.0	258.5	2,510.5	1,606.0

It will be observed that Lots I and II refused less hay and less stover than Lot III. In other words, the lots to which water was supplied continually consumed nearly the same amounts of coarse fodder. These two lots in this respect differed from each other much less than either differed from Lot III. Each lot was offered the same weight of hay and stover. It should be noticed, however, that the difference in the amount of coarse fodder refused, varied much more in the case of the corn stover than in the case of hay. For some reason, Lot III did not relish the corn stover so well as either of the other two lots. While this may be due somewhat to the individuality of the lot, yet the difference cannot be ascribed wholly to this without further trials. In determining the amount of stover consumed by each lot, the refuse was weighed back and carefully sampled, a moisture determination made, and the weight calculated to the original state of moisture. While it is true that the chemical

composition of the refuse would have differed somewhat from the original substance, yet the amount of dry matter consumed was accurately determined.

Weights and Gains.

The following table gives the weight of each steer and the total for each lot on alternate weeks from December 14 to April 19. It will be noticed that Lot I was slightly heavier than either Lot II or III at the beginning of the experiment, the animals of Lot I averaging 3½ pounds apiece heavier than those of Lot III, and about 54 pounds heavier than those of Lot II.

Weight of Steers at Each Weighing.

Steer No.	December 14.	December 28.	January 11.	January 25.	February 8.	February 22.	March 8.	March 22.	April 5.	April 19.
Lot I.										
91,	1,073.0	1,100.0	1,160.0	1,192.0	1,210.0	1,232.5	1,330.0	1,370.0	1,402.5	1,450.0
92,	990.0	1,020.0	1,042.0	1,192.0	1,105.0	1,132.5	1,190.0	1,230.0	1,255.0	1,290.0
93,	895.0	950.0	961.0	975.0	985.0	990.0	1,060.0	1,117.5	1,102.5	1,150.0
94,	998.0	1,007.0	1,043.5	1,043.0	1,065.0	1,102.5	1,167.5	1,200.0	1,210.0	1,260.0
95,	1,065.0	1,130.0	1,152.5	1,182.0	1,195.0	1,217.5	1,290.0	1,332.5	1,355.5	1,402.5
Total,	5,020.0	5,207.0	5,359.0	5,489.0	5,560.0	5,675.0	6,037.5	6,250.0	6,325.5	6,552.5
Lot II.										
86,	985.0	1,037.5	1,077.5	1,097.5	1,122.5	1,182.5	1,202.5	1,235.0	1,245.0	1,292.5
87,	892.5	927.5	977.5	1,004.5	1,030.0	1,070.0	1,112.5	1,155.0	1,155.0	1,227.5
88,	927.5	957.5	1,007.0	1,019.5	1,050.0	1,085.0	1,112.5	1,137.5	1,152.5	1,202.5
89,	972.5	972.5	1,010.0	1,029.0	1,062.5	1,082.5	1,105.0	1,130.0	1,147.5	1,187.5
90,	974.5	1,027.5	1,065.0	1,100.0	1,119.0	1,180.0	1,222.5	1,250.0	1,270.0	1,310.0
Total,	4,752.0	4,922.5	5,137.0	5,250.5	5,384.0	5,600.0	5,755.0	5,907.5	5,970.0	6,220.0
Lot III.										
81,	952.5	998.5	1,022.5	1,060.0	1,072.5	1,110.0	1,150.0	1,187.5	1,184.0	1,252.5
82,	1,002.5	1,045.0	1,087.5	1,125.5	1,145.0	1,200.0	1,215.0	1,255.0	1,283.0	1,317.5
83,	997.5	1,032.5	1,055.5	1,095.0	1,125.0	1,175.0	1,198.5	1,222.5	1,255.0	1,295.0
84,	1,072.5	1,090.0	1,123.0	1,155.5	1,180.0	1,232.5	1,250.0	1,270.0	1,300.0	1,337.5
85,	957.5	977.5	1,012.5	1,035.0	1,071.0	1,108.5	1,142.5	1,152.5	1,180.0	1,200.0
Total,	4,982.5	5,143.5	5,301.0	5,471.0	5,593.5	5,826.0	5,956.0	6,087.5	6,202.0	6,402.5

The Following Table Shows the Gain of Each Steer throughout the Experiment in Periods of Two Weeks Each:

Gain of Individual Animals at Each Weighing.

Steer No.	December 14.	December 28.	January 11.	January 25.	February 8.	February 22.	March 8.	March 22.	April 5.	April 19.
Lot I.										
91,		28	60	32	18	22.5	97.5	40	32.5	47.5
92,		30	22	50	13	27.5	57.5	40	25	35
93,		55	11	14	10	5	70	57.5	—*15	47.5
94,		9	36.5	4.5	17	37.5	65	32.5	10	59
95,		65	22.5	29.5	13	22.5	72.5	42.5	23	47
Total,		187	152	130	71	115	362.5	212.5	75.5	227
Lot II.										
86,		52.5	40	20	25	60	20	32.5	10	47.5
87,		35	50	27	25.5	40	42.5	42.5	.....	72.5
88,		30	49.5	12.5	30.5	35	27.5	25	15	50
89,		.....	37.5	19	33.5	20	22.5	25	17.5	40
90,		53	37.5	35	19	61	42.5	27.5	20	40
Total,		170.5	214.5	113.5	133.5	216	155	152.5	62.5	250
Lot III.										
81,		46	24	37.5	12.5	27.5	40	37.5	*—3.5	68.5
82,		42.5	42.5	38	19.5	55	15	40	28	34.5
83,		35	23	39.5	30	50	23.5	24	33	40
84,		17.5	33	32.5	24.5	52.5	17.5	20	30	37.5
85,		20	35	22.5	36	37.5	34	10	27.5	20
Total,		161	157.5	170	122.5	222.5	130	131.5	114.5	200.5

*Weighed less than at the previous weighing.

It will be readily seen that in the case of nearly every animal, the increase in weight throughout the experiment shows considerable variation, which is no doubt largely due to the amount of water retained in the system at the time of weighing. In each case the weighing was done at 9 A. M., and after the water had been withheld for 18 hours. It will be noticed that in but two instances was there shown to be an actual loss from the previous weight. Steer No. 93 in Lot I and steer No. 81 in Lot III each, on the 5th of April, weighed less than at the previous weighing, March 22. This may be accounted for, in part at least, by the fact that after April 1, corn meal was supplied in place of corn and cob meal, the proportion of bran being the same as before. This change of feed seemed to affect the animals somewhat unfavorably for a day or so. However, they soon came back to their former appetite and consumed their rations with the usual relish.

The following table gives the gain of each individual lot:

Steer No.	First weighing.	Last weighing.	Total gain, lbs.	Gain, per cent.	Gain per day, lbs.
Lot I.					
91,	1,072.0	1,450.0	378.0	35.26	3.00
92,	990.0	1,290.0	300.0	30.30	2.38
93,	895.0	1,150.0	255.0	28.49	2.02
94,	998.0	1,260.0	262.0	26.25	2.08
95,	1,065.0	1,402.5	337.5	31.69	2.68
Total,	5,020.0	6,552.5	1,532.5	30.53	12.17
Lot II.					
86,	985.0	1,292.5	307.5	31.22	2.44
87,	892.5	1,227.5	335.0	37.53	2.66
88,	927.5	1,202.5	275.0	29.65	2.18
89,	972.5	1,187.5	215.0	22.11	1.71
90,	974.5	1,310.0	335.5	34.43	2.66
Total,	4,752.0	6,220.0	1,468.0	30.89	11.65
Lot III.					
81,	952.5	1,252.5	300.0	31.49	2.38
82,	1,002.5	1,317.5	315.0	31.42	2.50
83,	997.5	1,295.0	297.0	29.77	2.36
84,	1,072.5	1,337.5	265.0	24.71	2.10
85,	957.5	1,200.0	242.5	25.33	1.92
Total,	4,982.5	6,402.5	1,420.0	28.50	11.27

From the above table it will be readily seen that Lot I made the greatest gain per day, although the gain in per cent. over the original weight did not quite equal that of Lot II. In Lot I, every animal gained more than two pounds per day, and one equaled or exceeded three pounds. In each of the other two lots there was at least one animal whose daily average gain was below two pounds per day during the whole time of the experiment.

The following table gives the amount of food consumed by each lot per pound of gain in live weight:

Food Consumed.

Per Pound Gain in Live Weight.

	Hay	Stover.	Grain.
Lot I,	3.61	1.02	6.95
Lot II,	3.72	.98	7.18
Lot III,	3.76	.64	7.43

There was not very much difference in the amount of hay consumed by the three lots per pound of gain in live weight, but the corn stover and grain varied considerably more. Lot III refused to eat as much corn stover as either Lot I or Lot II, but consumed about seven per cent. more grain for the same gain in live weight than Lot I.

It has been given as a reason for not feeding several steers in a pen that there was more danger of being a great variation in the gain than where stall feeding is practiced; in other words, that there would be more underlings that would not receive their proportion of food and would not, therefore, make so good gains as if they were protected from their larger and stronger companions. While a bunch of five steers is not sufficiently large to show whether this would be a serious objection, yet from the data secured from this trial, the indications are that there is practically no difference in regard to this point. At any rate, the gain of the individual animals in Lot I is quite as uniform as in Lots II and III.

Labor Required.

The following tabular statement indicates the amount of time in hours required for one man to care for each lot during the entire time of the trial:

Time of One Man Required for Attendance.

	Hours.	Percentage of Lot III.
Lot I,	93.66	76.0
Lot II,	113.33	92.0
Lot III,	123.25	

It will be noticed that Lot I received much less attention than either Lots II or III. In other words, it was found that one man could attend more animals in pens than would be possible where each individual was kept in a stall. It required much less time to clean out the stables, and it also took less time to properly litter or distribute the bedding. The stables were cleaned daily for Lots II and III, but from Lot I the manure was only taken out a few times during the whole experiment. In each case the same amount of litter was given each lot. Early in the experiment it was found that the animals in Lot I were keeping very much cleaner than the animals of Lots II and III. As all the animals were kept clean by the use of the brush and curry-comb, a considerable less time was necessary for this purpose in the case of Lot I than either of the other two lots.

Conclusions.

So far as any conclusions are warranted from a single experiment with a few animals, the above results would seem to indicate that dehorned steers can be fed in pens, in the manner practiced with Lot I, with at least as satisfactory results as regards gain as when handled in the more common way, while there is a very considerable saving in the amount of work required to properly care for them.

The self-watering device also saved considerable work and possibly effected some economy in the amount of grain consumed per pound of gain, although the unavoidable differences between the lots render this conclusion far from certain.